

Latitudinal – local time distribution of the O₂ and OH infrared nightglows and O density in the Venus lower thermosphere

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Abstract

Atomic oxygen has been measured in situ only above 145 km on both the day and the night sides of Venus. Limb observations obtained with the Venus Infrared Thermal Imaging Spectrometer (VIRTIS) on board Venus Express show that the O₂ infrared nightglow peaks at ~97 km [1, 2], with a mean intensity value of about 1 MR. Yet, the distribution is largely inhomogeneous, with an enhanced region of ~3 MR statistically located near the midnight meridian at low latitude [3].

The oxygen density can be mapped using the O₂ airglow and CO₂ density vertical distributions [4]. The O₂ volume emission rates are obtained with an Abel inversion of the O₂ limb profiles using CO₂ vertical distributions taken from the Venus International Reference Atmosphere (VIRA) model. The results show that the O density peak varies in altitude with a mean value of 105 km. It ranges from 1.0×10^{10} to 14.5×10^{11} cm⁻³, with a mean value of 2.2×10^{11} cm⁻³. The zonally averaged peak altitude appears to be constant while its amplitude decreases with latitude.

Another approach uses the O₂ volume emission rates obtained with an Abel inversion of the O₂ limb profiles. Indeed, it is then possible to vertically integrate these profiles to simulate nadir observations. The resulting map gives values between 0 and 2.8 MR (with a mean value of 0.6 MR) in the north hemisphere. A statistical map created with actual nadir observations shows intensities ranging from 0 to 2.1 MR, with a mean of 0.5 MR in the south hemisphere. A combination of the two types of observations could cover Venus entire nightside.

Statistical mapping of the OH Meinel emission has also been performed using limb profiles. A strong

correlation with the O₂ emission is revealed. The average altitude of the emission peak is ~95.3 km for the OH(1-0) band and the average intensity is 0.4 MR [5].

References

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